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PCT/JP96/03084	October 23, 1996	

TITLE OF INVENTION
BIOCHEMICAL ANALYZER

510 Rec'd PCT/PTO 22 APR 1999

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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [XX] This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. [X] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. [X] has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [X] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [ ] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [XX] Other items or information:

International Publication NO. WO98/18009
International Search Report
Information Disclosure Sheet Under 37 CFR 1.56 with Copies of Indicated Documents
Change of Correspondence Address
Figures 1-8, 9a-9e

U.S. Application No.	International Application No. PCT/JP96/03084	Attorney's Docket No. 500.37156X00

7. [XX] The following fees are submitted:

		CALCULATIONS PTO USE ONLY
ASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Search Report has been prepared by the EPO or JPO	$ 840.00	840.00
International preliminary examination fee paid to USPTO (37 CFR 1.482)	$ 670.00	
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	$ 490.00	
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$ 700.00	
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	$ 96.00	

ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840.00	
Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	14-20 =	Ø	X 18.00	$	
Independent claims	5-3 =	2	X 78.00	$ 156.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ 260.00	$	
TOTAL OF ABOVE CALCULATIONS =				$ 996.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also by filed (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$ 996.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).			+	$	
TOTAL NATIONAL FEE =				$ 996.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property			+	$ 40.00	
TOTAL FEES ENCLOSED =				$ 1,036.00	
				Amount to be: refunded	$
				charged	$

a. [XX] A check in the amount of $ 1,036.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [XX] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-2135. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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BIOCHEMICAL ANALYZER

BACKGROUND OF THE INVENTION

The present invention relates to a biochemical analyzer which can automatically carry out a series of operations including supply of specimens, and conveyance, analysis and storage thereof in a clinical analyzing apparatus for biochemically analyzing or immuno-analyzing blood, urine or the like.

Related Art

There has been well-known a conventional automatic biochemical analyzer comprising a specimen introducing part for introducing a specimen rack on which specimens are set, a specimen storage part for storing therein specimens for which analysis has been completed, the specimen introducing part being arranged at one end of the analyzer and the specimen storage part being arranged at the other end thereof, and a plurality of analyzing parts which are combined in accordance with a use purpose, and which are laid on a straight line between the specimen introducing part and the specimen storage part.

It is noted that a specimen rack conveying part for conveying the specimen rack is arranged on the rear side of the specimen introducing part, the analyzing parts and the specimen storage part, being integrally incorporated therewith, and accordingly, the specimen

introducing part, the analyzing parts and the specimen storage parts are indirectly coupled with one other by means of the specimen rack conveying part.

Further, Japanese Patent Unexamined Publication No. 03-28517 discloses such an automatic analyzer that coupling parts for coupling the specimen rack conveying part with the specimen introducing and storage parts and the analyzing parts, are provided between the specimen introducing part and an analyzing part adjacent thereto, between adjacent analyzing parts, and an analyzing part adjacent to the specimen storage part and the latter, the outside dimensions and inside dimensions of the coupling parts are different from each other so as to allow the automatic analyzer to have an L- or U-like configuration, whereby distances by which laboratory technicians (including specialists and others) move, and a space in a room in which the biochemical analyzer is arranged, are effectively used.

However, in the above-mentioned conventional biochemical analyzer which is arranged in such a configuration other than a straight line configuration, the whole floor area of the biochemical analyzer is increased since the coupling parts are provided. Further, since it can be arranged in any of configurations other than a straight line configuration, an examination room having a short straight line distance can be installed, and accordingly, there can been proposed a biochemical analyzer which does not require a large-sized examination

room so as to effect space saving. However, there has not yet been proposed enhancement of the environment of the examination room and the convenience requested by the technicians.

Meanwhile, in a usual examination room, a plurality of analyzing parts as mentioned above, have various sizes and shapes since inspection items and processing speeds are different from one another, and the heights of the analyzing parts are set to be higher than the height of the view points of women who cannot therefore look around the examination room in its entirety.

Further, in such a case that the shortening of examination times and the addition of inspection items are required, additional analyzing parts should be built up in an original biochemical analyzer, and if a biochemical analyzer becomes old, the analyzer should be replaced with new one. As a result, analyzing parts and peripheral equipment having various sizes are arranged in disorder.

Thus, the space of the examination room becomes small and uncomfortable, and has a dark atmosphere, that is, there has been such a problem that the environment of the examination room becomes worse.

With the provision of a single analyzer in an examination room, no serious problem occurs. However, with the provision of several analyzers coupled with one other in the examination room, the analyzer themselves

exhibit the environment of the examination room in part, and accordingly, the environment of the examination room which serves as a life space for laboratory technicians gives a serious problem in working efficiency.

Further, in the case of the arrangement of a plurality of analyzers, it is impossible to easily recognize, at glance, where a specific analyzer is arranged, that is, unnecessary visual elements are present for the laboratory technicians so as to hinder rapid and sure examination.

Further, even though the biochemical analyzer can automatically carry out a series of operations such as supply, conveyance, analysis and storage of specimens, the laboratory technicians have to carry out adjustment for a sampling mechanism, replacement of components or the like, replenishment of reagents, and confirmation for operating conditions of the analyzer. In order to carry out the above-mentioned works for such an arrangement in which analyzing parts having housings of different sizes, and working surfaces of different heights, the laboratory technicians have to set their sights too high or crouch down, accordingly, simplicity and rapidness are hindered, thereby there has been a problem such that the processing capability of the biochemical analyzer cannot be fully utilized.

Further, in such a case that any one of a plurality of analyzing parts fails, the examination has to be inevitably stopped until repairing thereof is

completed, even though the examination does not use the analyzing part in failure, since a specimen rack conveying part is incorporated with each of the analyzing parts.

Further, in such a case, due to failure, wear-out or old style, any one of a plurality of analyzing parts has to be replaced with new one, the attachment of a new analyzing part requires the positioning of the specimen rack conveying part, and the positioning of the housing of the analyzing part.

Moreover, if the position of arrangement of an analyzing part to be replaced, is present between the specimen introducing part and the specimen storage part, the other analyzing parts have to be shifted with the use of either the specimen introducing part or the specimen storage part as a reference point, accordingly, much and heavy labor and long time are required for the replacement.

SUMMERY OF THE INVENTION

The present invention is devised in view of the above-mentioned problems of the present invention, and accordingly, an object of the present invention is to provide an automatic biochemical analyzer which can provide a safe and clean environment, and which can maintain a high degree of reliability, and which can exhibit within the examination room such a working environment that the technicians can hold his comfortable

feeling of tension, and the management therefore can be made in order.

Further, another object of the present invention is to provide an automatic analyzer in which arranged analyzing parts exclude unnecessary elements, that is, only have required elements so as to exhibit an existential quantifier, and the laboratory technicians can rapidly and precisely confirm specified parts, and can rapidly discrete a situation so as to rapidly cope with the situation.

Further, another object of the present invention is to provide an automatic biochemical analyzer in which not only distances by which the laboratory technicians move can be shortened, but also dimensions with which the laboratory technicians can carry out a series of operations in a reasonable posture can be set, thereby it is possible to reduce physical fatigue, and which can always carry out safe and precise examination even in a long working time.

According to the present invention, the longitudinal dimension of the specimen rack is used as a basic dimension, the widthwise dimensions of the specimen introducing part and the specimen storage part are set to values which are multiples of the longitudinal dimension of the specimen rack, and the analyzing parts are coupled with one another through the intermediary of the specimen rack conveying parts.

Accordingly, the external dimensions can be

standardized so that respective equipment can be harmonized so as to exhibit sensation of unity, and human's sensory function can be controlled so as to exhibit a comfortable environment for the laboratory technicians.

Further, another object of the present invention is to provide an automatic biochemical analyzer in which the standardization of the external dimensions are effective for common use of components, and the replacement of a component with new one is simple while its expandability is flexible.

Further, the user's areas which are provided in analyzing parts, for allowing the laboratory technicians to confirm and perform analysis have a uniform height which is lower than that of the view points of the laboratory technicians.

Thus, components in the examination room have a uniform low height so that the examination can be looked around in the examination room in its entirety, thereby it is possible to provide a bright and broad environment for the laboratory technicians.

Further, component parts which the laboratory technicians usually manipulate, and for which a periodical maintenance has to be made, are made to be noticeable by colors and shapes, so as to be visually distinguished from other parts.

Accordingly, there can be provided an automatic biochemical analyzer in which the laboratory technician

can recognize at a glance where a specific component is present, even in such a case that not less than two analyzing parts are arranged, whereby it is possible to exhibit a feeling of safety and a feeling of intimacy for the laboratory technicians.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view illustrating a biochemical analyzer according to the present invention;

Fig. 2 is a longitudinal sectional view illustrating an analyzing part A shown in Fig. 1;

Fig. 3 is a view for explaining a relationship between the analyzing part A and the height of a worker;

Fig. 4 is a view for explaining a working range in an analyzing part B shown in Fig. 1;

Fig. 5 is a plan view for explaining widthwise dimensions of the automatic biochemical analyzer according to the present invention;

Fig. 6 is a conceptual view for explaining the relationship among structural parts of the biochemical analyzer according to the present invention;

Fig. 7 is a schematic view illustrating a flow of a specimen;

Fig. 8 is a schematic view for explaining a replacement of analyzing parts; and

Figs. 9a to 9e are schematic views illustrating various configurations of biochemical analyzers according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Detailed explanation will be hereinbelow made of the present invention in the form of preferred embodiments with reference to the accompanying drawings.

Referring first to Figs. 2 and 3, although a specimen rack conveying part 20, a specimen introducing pat 1, an electrolyte analyzing part 2, an analyzing part 3 and an analyzing part 4, a reexamining buffer 5 and a specimen storage part 6 are shown, being separated from each other for the sake of brevity of explanation, no gaps are inherently present at positions where their housings are arranged, adjacent to one another with no gaps therebetween.

Referring to Figs. 1 and 2, the biochemical analyzer according to the present invention, comprises a specimen introducing part 1 for introducing a specimen rack in which specimens are accommodated, an electrolyte analyzing part 2, an analyzing part 3 provided with a reagent cold reservoir 30 projected from the top surface of a housing thereof, an analyzing part 4, a reexamining buffer 5 for temporarily accommodating the specimen rack for reanalysis, and a specimen storage part 6 for accommodating therein the specimen rack for which examination is completed, they all being arranged in a one horizontal row.

The specimen introducing part 1, the electrolyte analyzing part 2, the analyzing part 3, the analyzing part 4, the reexamining buffer 5 and the

specimen storage part 6 are coupled to one another through the intermediary of a specimen rack conveying part 20 including a conveyer for conveying the specimen rack, which is laid on the rear side of them and which controls the flow of the specimen rack.

It is noted the specimen rack conveying part 20 is composed of an on-going path 21 on which the specimen rack is advanced from the specimen introducing part 6 to the specimen storage part 6, and an in-coming path 22 on which the rack is advanced in a direction reverse to that of the on-going path. A removable transparent cover 23 is provided at the top surface of the specimen rack conveying part 20.

The above-mentioned specimen introducing part 1, the electrolyte analyzing part 2, the analyzing part 3, the analyzing part 4, the reexamining buffer 5, the specimen storage part 5 and the specimen storage part 6 are composed of base parts 7 having one and the same shape and size, and accordingly, it is apparent that they are bundled in one unit by the base parts 7.

The analyzing part 3 carries out an analysis at a high speed so that the time for the analysis is short since the number of analyzing items is small, while the analyzing part 4 has a large number of analyzing items so that the time for the analysis is long, and accordingly, they are selectively used, depending upon the content of an analysis.

Further, slits 8a to 8r are formed in the front

surface sides of the respective components as mentioned above with a dimensional unit serving as a base of the widthwise dimensions of the components.

With this arrangement, even in a system in which not less than two independent analyzers are arranged in conformity with an examination facility, the dimensions of the respective analyzers are normalized being well-ordered, and functioning stations are arranged in the order of working steps by means of the base parts 7 and the slits 8 provided in the respective analyzers, thereby it is possible to exhibit the appearance of the system as a continuous and integral device.

It is noted that the above-mentioned slits 8a to 8r are shown in the form of grooves in this embodiment, they should not be limited to these grooves, but instead thereof, beads projected from the housings, or color strips having smooth surfaces may be used if they can visually and continuously recognized

Further, the slits 8a to 8r may be in a combination of grooves, beads and color strips.

Further, function identification parts 9a, 9b for indicating analyzing parts where a specimen is added therein with a reagent so as to analyze components of the specimen are formed on the front surface sides of the analyzing parts 3, 4, and stages 10a, 10b for exhibiting user's zones includes a part where a laboratory technician opens and closes the cover, prepares and adjusts a sample probe or the like, and replaces

consumable things such as reagents, and a control part for instructing manipulations which are not shown.

With the provision of the above-mentioned identification parts 9a, 9b, in a biochemical analyzing system in which not less than two standardized analyzers are arranged, the laboratory technician can soon recognize at a glance where a specific component is located, at any position which is far from a particular analyzer, or near thereto, thereby it is possible to prevent the view point from being uselessly moved or displaced.

Further, with the provision of the stages 10a, 10b, a part the technician has directly touch, can be instantly recognized.

It is noted that there are shown the function identification parts 9a, 9b which are concave shapes projected respectively from the housings of the analyzing parts. However, they should not be limited to such shapes, but they may be concave shapes or smooth color surfaces if they can be visually distinguished from other parts. Further, although the above-mentioned stages are provided as separate members on the top surfaces of the respective analyzing parts, the present invention should not be limited to this arrangement, but they may be those which are colored parts directly applied to the top surfaces of the respective analyzing parts.

If the stages 10a, 10b can be exhibited in combination with colors, the parts can be easily

distinguished from others, and accordingly, the laboratory technician can instantly and precisely recognize the presence thereof so as to exhibit higher technical effects.

Explanation will be hereinbelow made of external dimensions of the apparatus according to the present invention.

The height h1 of an analyzing part 3 is set to be in a range from 850 to 920 mm while a height H2 of the stages 10a is set to be in a range from 850 to 950 mm, and the height h3 of the reagent cold reservoir 30 is set to be in a range from 1,350 to 1,650 mm.

Further, the inward depth d2 of the analyzing part 3 is set to be in a range from 650 to 750 mm, the forward side depth d1 of the specimen rack conveying part 20, measured from the center position of the on-going path 21 is set to be in a range from 750 to 800 mm.

It is noted that the height and depth of the analyzing part 4, and the height of the stage 10b are the same as those of the analyzing parts 2 as mentioned above although they are not shown in detail.

Further, the specimen introducing part 1, the reexamining buffer 5 and the specimen storage part 6 are provided with covers 11a, 11b, 11c, instead of stages 10a provided in the analyzing part 3, and the electrolyte analyzing part 2 is provided with a top panel 12, instead of the stage 10b. In this arrangement, the heights of the specimen introducing part 1, the reexamining buffer 5

and the specimen storage part, and the heights of the covers 11a, 11b, 11c and the top panel 12 are the same as those explained as to the analyzing part 3.

Further, as to the heightwise dimensions of the specimen rack conveying part 20, the height h4 of the cover 23 provided to the specimen rack conveying part 20 is set to be in a range from 850 to 950 mm, and the overall height h5 of the specimen rack conveying part 20 is set to be in a range from 760 to 950 mm in view of such a fact that the height of the specimen rack is 70 mm, and the specimen rack conveying part 20 is not projected from the top surface of the analyzing part 3. Further, a height h6 of a conveyer line which is not shown, is set to be 690 to 790 mm.

Since Japanese adult women have an averaged height h8 of 1,580 mm, and since the height h7 of their view points is a 1,460 mm, the overall height of the biological analyzing apparatus is standardized in a range from 850 to 950 mm, as mentioned above, and accordingly, the height of the biologically analyzing apparatus is set to be lower than the height of the view point of the laboratory technician.

If an object which is higher than the view point of the user himself, is present, apprehension is felt, and accordingly, the space is recognized to be narrower than that actually obtained. However, if the examination room can be looked around in its entirety, the human's sensory function can be controlled so that

the space can be recognized to be bright and broad.

As a result, a comfortable environment can be provided so as to reduce the mental apprehension in order to alleviate the fatigue even in a long time examination work, thereby it is possible to take concentration on the examination work.

Since the depthwise dimensions of the apparatus is uniformed, no protrusions and recesses are present on the front and rear sides of the device, no useless floor area is present, and accordingly, it is possible to aim at saving the space. Further, since the external appearance is continuous with no external protrusions and recesses visual noises can be reduced.

Further, in the automatic biological analyzer having the above-mentioned dimensions, if a Japanese adult woman takes a standing posture as well as a reasonable forward tilting posture at a tilting angle of less than 30 deg., the depth d2 by which her hands can reach by stretching her arms, is in a range of 700 to 800 mm.

Thus, the hands can reach up to the center position of the on-going path 21 of the specimen rack conveying part 20 with a reasonable posture.

Accordingly, even if an abnormality occurs in the specimen rack conveying part 20 laid on the most inward side during examination, the hands can reach a require part without changing the working posture and without taking an unreasonable posture, thereby it is

possible to safely and rapidly carry out the examination work.

It is noted that the reagent cold reservoir 30 provided in the analyzing part 3, is accommodated therein with a reagent container 31 containing therein a reagent solution which is fed into the analyzing part 3 through a reagent tube 32.

In the front surface part of the reagent cold reservoir 30, an opening having a top surface depth and a bottom surface depth which is larger than the former, is formed, and the opening is covered with an opening and closing transparent cover 33 defining a curved surface.

The above-mentioned reagent cold reservoir 30 has a height h3 which is in a range of 1,350 to 1,650 mm, and accordingly, the remaining quantity of the reagent solution in the reagent container 31 can be confirmed easily at a position which is lower than the view point of a Japanese adult woman. Alternatively, it can be easily confirmed by slightly upward directing her glance.

Further, even a person who is taller than Japanese adult women having an averaged height, can easily confirm the remaining quantity of the reagent solution in the reagent container 31 by obliquely downward directing his glance.

Further, since the opening and closing cover 33 has a curved surface, even though condensation occurs in the cover 33, no water droplets drop into the reagent container 31.

Next, explanation will be made of the widthwise dimensions of the components in this embodiment of the present invention.

According to the present invention, the specimen rack on which specimens are set, is conveyed by the specimen rack conveying part 20 to the respective analyzing parts so as to automatically analyze it. Thus, widthwise dimensions of the components are set, using the longitudinal dimensions of the specimen rack as a base.

The longitudinal dimension of the specimen rack including a drive part is 150 mm, the widthwise dimensions w1, w2, w5, w6 of the specimen introducing part 1, the electrolyte analyzing part 2, the reexamining buffer 5 and the specimen storage part 6 are set to 300 mm which is a multiple of the longitudinal dimension of the specimen rack.

Further, the analyzing part 3 and the analyzing part 4 have widthwise dimensions w3, w4 is set to 1,200 mm which is a multiple of the longitudinal dimension of the specimen rack.

Further, slits at intervals of 150 mm which is the longitudinal dimension of the specimen rack are formed in the front surface sides of the specimen introducing part 1, the electrolyte analyzing part 2, the reexamining buffer 5 and the specimen storage part 6.

As mentioned above, since the heights and widths of the housing of the components are standardized, and the slits are formed at equal intervals, even in such

a case that not less than two independent analyzing parts are arranged in the examination room, the analyzer can exhibit a continuous external appearance.

With this arrangement, visual noise can be reduced for the laboratory technician.

Referring to Fig. 6 which is a conceptual view for explaining a relationship of the structure of the biochemical analyzer according to the present invention, and Fig. 7 which is a schematic view illustrating the flow of the specimen, the method of installation of the biochemical analyzer according to the present invention and the flow of the specimen will be explained. It is noted that the arrows indicated in Fig. 6 exhibit that accuracy is required for the positional relationship between two components.

Further, if a capability of installations in the examination room and the arrangement of the biochemical analyzer according to the present invention are determined, a required length of the specimen rack conveying part 20 can be determined since the widths of the analyzing parts are standardized.

After the arrangement of the specimen rack conveying part 20 in the examination room is completed, the specimen introducing part 1, the electrolyte analyzing part 2, the analyzing part 3, the analyzing part 4, the reexamining buffer 5 and the specimen storage part are connected to the specimen rack conveying part 20.

In this arrangement, the specimen introducing

part 1, the reexamination buffer 5, and a sample probe 32a in the specimen storage part 6 should be precisely connected to a conveying line provided in the specimen lack conveying part 20.

It is noted that structure of the analyzing part 3 comprises a submodule 14 composed of a take-in buffer 33, a sample probe 32, a reaction disc 35, a reagent probe 38 and a specimen rack discharge part 37, and a submodule 15 composed of an electric substrate, a pump and a washing liquid which are not shown, and a submodule 16 including the reagent cold reservoir 30.

Further, the structure of the analyzing part 4 is composed of the submodule 14 in which the reagent is added, the submodle 16 being eliminated.

In the above-mentioned arrangement, the take-in buffer 33 should have accuracy in connection with the conveying line, and the structures included in the submodule 14 should have accuracy in connection.

Then, explanation will be made of the flow of the specimen. Specimen racks 40a, 40b arranged in the specimen introducing part 1, are shifted onto the specimen rack conveying part 20, and are thereafter carried into the electrolyte analyzing part 2 having a highest frequency of reliance in clinical biochemical examination.

The above-mentioned electrolyte analyzing part 2 is provided therein with a sample probe 32 by which a sample can be directly taken out from the specimen rack

40c on the specimen rack conveying p art 20.

A sample taken out from a first specimen on the specimen rack which has been stopped on the specimen rack conveying part 20, is measured by ion selective electrodes which are not shown, and the results of the measurements are outputted to a printer or a display which are not shown.

If measurement items set in the electrolyte analyzing part 2 are requested further for the first specimen, the above-mentioned sampling is repeated. Further, similar sampling is repeated for specimens subsequent to the second one. The sampling is continued until the sampling for the measurement items which are set for all specimens on the specimen rack in the electrolyte analyzing part 2 are completed.

Next, as to the specimen rack 40c for which the sampling in the electrolyte analyzing part 2 has been completed, whether measurement items set in the analyzing part 3 are requested for specimens on the specimen rack or not is determined by a computer in a control part which is not shown. If the measuring items are requested for even only one of the specimens, the specimen rack is moved to the analyzing part 3.

The take-in buffer 33a is provided in the analyzing part 3, and the specimen rack 40d is taken into the sampling part 30 from the specimen rack conveying part 20, and a sample taken out from the specimen rack 40d by a constant quantity is pipetted onto a reaction

disc 35a by the sampling probe 32b. Thereafter, a predetermined quantity of a reagent is pipetted onto the reaction disc 35a by the reagent sample probe, and after the reaction by a predetermined time, the sample is measured by a photometer which is not shown, and then, the results of the measurement are outputted to a printer or a display which are not shown.

It is noted that the measurement items set in the analyzing part 3 are also requested for a specimen located at a first position, the above-mentioned sampling is repeated. Further, the same operation can be repeated for specimens subsequent to the second one, and the sampling is repeated until the sampling for all measurement items set in the analyzing part 3 for all specimens on the specimen rack is completed.

Next, as to the specimen rack for which the sampling in the analyzing part 3 is completed, whether measurement items set in the analyzing part 4 are requested for any of specimens on the specimen rack or not is determined by the computer in the control part which is not shown. If the measuring items is requested for even only one of the specimens, the specimen rack is discharged onto the specimen rack conveying part 20, by the specimen rack discharge part 37a and is carried into the analyzing part 4. After the specimen rack is carried into the sampling part 34b by the take-in buffer 33b, samples are pipetted on the reaction disc 35b, and thereafter, predetermined quantities of the reagent are

pipetted onto the reaction disc 35b from the reagent set on a reagent disc 36 by a reagent probe 38. After a predetermined time elapses, the sample are measured by a photometer which is not shown, and the results of the measurements are outputted to the printer or the display which are not shown.

It is noted that the specimen rack for which the sampling is completed in the analyzing part 4 is carried to a specimen rack discharge part 37b by which it is returned to the rack conveying part 20, and is then carried to the reexamining buffer 5.

The specimen rack 40f having been carried to the reexamining buffer 5, is held therein until the analysis is completed, and then, the specimen rack with no abnormality found in the analysis is conveyed to the specimen storage part 6 under the control of the computer in the control part which is not shown.

Further, the specimen rack with an abnormality found in the analysis is returned onto the specimen rack conveying part 20 by which it is conveyed again to the associated analyzing parts so as to repeat the above-mentioned analysis.

Further, an emergency specimen introducing part 13 is present in the left upper end part of the specimen introducing part 1. If a specimen rack 140 is set in the emergency specimen introducing part 13 while a specimen rack is present in the specimen introducing part 1, the specimen rack 40h is carried onto the specimen rack

conveying part 20 from the emergency specimen introducing part 1, preferential to the specimen rack present in the specimen introducing part 1.

Meanwhile, after the sampling in the electrolyte analyzing part 2 is completed, if no more measurement items set in the analyzing parts 3, 4 are requested, the specimen rack is carried to the specimen storage part 6 on the specimen rack conveying part 20, and is then stored in the specimen storage part 6.

Further, after the sampling in the electrolyte analyzing part 2 is completed, and further after the sampling in the analyzing part 3 is completed, if no measurement items set in the analyzing part 4 are requested, the specimen rack is carried to the specimen storage part 6 by the specimen rack conveying part 20, and is stored in the specimen storage part 6.

As mentioned above, since the specimen rack conveying part 20 is independent from the other components, even though any one of the plurality of analyzing parts fails, if the analysis can be made in any other analyzing part, it is not necessary to completely stop the analysis.

Fig. 8 is a schematic view for explaining the replacement of analyzing parts. The dimensions of the automatic analyzer according to the present invention is standardized as mentioned above, and further, the respective analyzing parts are coupled to one another by the specimen rack conveying part 20.

In view of this fact, if, for example, the analyzing part 4 fails, becomes deteriorated, or malfunctions so that it has to be replaced, the analyzing part 4 is removed from the specimen rack conveying part 20, and a new analyzing part 50 is inserted in a space formed by the removal of the analyzing part 4, and is connected with the specimen rack conveying part 20. Accordingly, the replacement can be made simply and shortly with no displacement of the other components.

Although it has been explained that all components are arranged on one straight line along the specimen rack conveying part 20 in this embodiment, the arrangement of the components can be simply changed only by changing the configuration of the specimen rack conveying part 20.

Figs. 9a to 9e show other configurations of the biochemical analyzer according to the present invention. It is noted that like reference numerals are used to denote like parts which have explained in Figs. 1 to 8.

Referring to Fig. 9a, specimen rack conveying parts 20a, 20b, 20c are arranged in a U-like shape, and rotors 60a, 60b for changing the advancing direction of the specimen rack 40 are arranged between the specimen rack conveying part 20a and the specimen rack conveying part 20b and between the specimen rack conveying part 20b and the specimen rack conveying part 20c. Further, the specimen introducing part 1 and the specimen storage part 6 and the components located between therebetween are

arranged along the specimen rack conveying part 20a, 20b, 20c laid in the U-like shape.

Referring to Fig. 9b, specimen rack conveying parts 20a, 20b, 20c are arranged in a U-like shape, and rotors 60a, 60b for changing the advancing direction of the specimen rack 40 are arranged between the specimen rack conveying part 20a and the specimen rack conveying part 20b and between the specimen rack conveying part 20b and the specimen rack conveying part 20.

Further, corner tables 61a, 61b are arranged between the specimen rack conveying part 20a and the specimen rack conveying part 20b and between the specimen rack conveying part 20b and the specimen rack conveying part 20c. These corner tables 61a, 61b may be used as setting beds for peripheral units used for the examination work, and further, they may be used as an accommodation bed for consumable parts or the like.

Further, the specimen introducing part 1 and the specimen storage part 6 and the component parts therebetween are arranged along the specimen rack conveying part 20a, 20b, 20c arranged in the U-like shape.

The configurations shown in Figs. 9a and 9b can be applied in an examination room having a relatively short direct distance. Further, since a working space can be obtained between apparatuses arranged therein, that is, the analyzers are opposed to each other with the working space therebetween. Thus, a large number of components can be monitored simultaneously, and further the distance

by which the laboratory technician moves, can be shortened.

In particular, on the side on which the thus arranged analyzer is opened, the specimen introducing part 1 and the specimen storage part 6 can be opposed to each other, and accordingly, the distance by which the laboratory technician moves can be shortened.

Referring to Fig. 9c, specimen rack conveying parts 20a, 20b are arranged in an L-like shape, and a rotor 60a for changing the advancing direction of the specimen rack 40 is arranged between the specimen rack conveying part 20a and the specimen rack conveying part.

Further, the specimen introducing part 1 and the specimen storage part 6 and the components therebetween, are arranged along the specimen rack conveying part 20a, 20b arranged in the L-like shape.

According to the configuration shown in Fig. 9c, the analyzer can be arranged in an examination room having a relative short direct distance, and at each corner of an examination room, and a large number of components can be monitored simultaneously. Accordingly, the distance by which the laboratory technician moves, can be shortened.

Referring to Fig. 9d, a bent L-like module 70 is arranged in order to change the advancing direction of the specimen rack into a direction perpendicular thereto, and a specimen rack conveying part 20a and a specimen rack conveying part 20b are arranged at opposite ends of

the bent module 70, respectively.

Further, a rotor 60a for changing the advancing direction of the specimen rack 40 is arranged between the specimen rack conveying part 20a and the specimen rack conveying part 20b.

In this bent module 70, the specimen rack carried by the specimen rack conveying part 20a is slid onto the analyzing part 4, and when the specimen rack reaches a corner of the bent module 70 on the analyzing part 4, the specimen rack is slid onto the rotor 60a in the bent module 70a although such an arrangement is not shown.

In a general hospital building in which posts 62 having a size of 600 to 1,000 mm are arranged in each span (6000 mm), the configuration shown in Fig. 9c can be arranged with no interference with the posts 62. Thus, it is possible to effectively use the installation space.

Referring to Fig. 9e, specimen rack conveying part 20a and specimen rack conveying part 20b are arranged in a back-to-back relation, and rotors 60a, 60b for changing the advancing direction of the specimen rack 40 are arranged between the specimen rack conveying part 20a and the specimen rack conveying part 20b.

Further, the specimen introducing part 1 and the specimen storage part 6 and the components therebetween are arranged along the specimen rack conveying part 20a, 20b arranged in the back-to-back relation.

With the configuration shown in Fig. 9e, the analyzer can be arranged in an examination room having a short direct distance, thereby it is possible to aim at saving the installation space in the examination room.

Although it has been explained that the biochemical analyzer according to the present invention is composed of the specimen introducing part, the electrolyte analyzing part 2, the analyzing part 3, the analyzing part 4, the reexamining buffer 5, the specimen storage part and the specimen rack conveying part 20, several kinds of analyzing parts, the same kind of analyzing parts or the combination thereof may be selected in accordance with a kind of an examination facility.

Further, although not shown, a preprocessing device such as a centrifugal separator, a specimen stocker as a peripheral unit may be combined with the above-mentioned analyzer.

WHAT IS CLAIMED IS:

1. A biochemical analyzer for automatically analyzing a specimen, comprising a specimen introducing part for introducing a specimen rack, a specimen rack conveying part for conveying said specimen rack received from the specimen introducing part, to an analyzing part, said analyzing part pipetting a specimen on the examination rack and allowing the specimen to react with a reagent so as to analyze the specimen, and a specimen storage part for storing the specimen rack for which the pipetting is completed, the specimen introducing part, the rack conveying part, the analyzing part and the specimen storage parts being independent from each other, and the specimen introducing part, the analyzing part and the analyzing storage part being arranged and coupled along the longitudinal direction of the specimen conveying part.

2. A biochemical analyzer as set forth in claim 1, wherein the specimen introducing part, the analyzing part and the specimen storage part which are arranged along the specimen conveying part have lengths which are equal to one another.

3. A biochemical analyzer as set forth in claim 1, further comprising a reexamining buffer for temporarily holding a specimen for which pipetting is completed in the analyzing part.

4. A biochemical analyzer for automatically analyzing a specimen, comprising a specimen introducing

part for introducing a specimen rack, a specimen rack conveying part for conveying said specimen rack received from the specimen introducing part, to an analyzing part, said analyzing part pipetting a specimen on the examination rack and allowing the specimen to react with a reagent so as to analyze the specimen, a specimen storage part for storing the specimen rack for which the pipetting is completed, the specimen introducing part, the rack conveying part, the analyzing part and the specimen storage parts being independent from each other, and being arranged on a floor, and the specimen introducing part, the analyzing part and the analyzing storage part having heights measured from the floor, and depths which are substantially equal to one another in their contact parts.

5. A biochemical analyzer as set forth in claim 4, wherein the specimen introducing part, the rack conveying part, the analyzing part and the specimen storage parts have heights which are set in a range of 850 to 950 mm measured from the floor surface on which the analyzer is installed, and depths which are set in a range of 750 to 800 mm.

6. A biochemical analyzer for automatically analyzing a specimen, comprising a specimen introducing part for introducing a specimen rack, a specimen rack conveying part for conveying said specimen rack received from the specimen introducing part, to an analyzing part, said analyzing part pipetting a specimen on the

examination rack and allowing the specimen to react with a reagent so as to analyze the specimen, a specimen storage part for storing the specimen rack for which the pipetting is completed, the specimen introducing part, the rack conveying part, the analyzing part and the specimen storage parts being independent from each other, and the specimen introducing part, the analyzing part and the specimen storage part having widthwise dimensions which are multiples of the longitudinal length of the specimen rack, including 1.

7. A biochemical analyzer as set forth in claim 6, wherein slits having a length equal to the longitudinal length of the specimen rack are formed in the front surface sides of the specimen introducing part, the analyzing part and the specimen storage part.

8. A biochemical analyzer for comprising an introducing part for introducing a specimen, and a storage part for storing the specimen, and an analyzing part for allowing the specimen to react with a reagent so as to analyze the specimen, said introduction part, the storage part and the analyzing parts having patterns which are identical with one another, the analyzing part having an identification part on the front surface side thereof.

9. A biochemical analyzer as set forth in claim 8, wherein the identification part is projected from the housing.

10. A biological analyzer as set forth in claim 8,

wherein the identification part is concave.

11. A biochemical analyzer as set forth in claim 8, wherein the identification part has a color which is different from that of the other part of the front surface of the housing.

12. A biochemical analyzer for comprising an introducing part for introducing a specimen, and a storage part for storing the specimen, and an analyzing part for allowing the specimen to react with a reagent so as to analyze the specimen, wherein stages are provided on the top surface sides of the specimen introduction part, the specimen storage part and the analyzing part, at positions where the user carries out confirmation, adjustment and replacement during analysis.

13. A biochemical analyzer as set forth in claim 12, wherein the stages are projected from the top surface side of the housing.

14. A biochemical analyzer as set forth in claim 12, wherein the stages has a color which is different from the other part of the front surface of the housing.

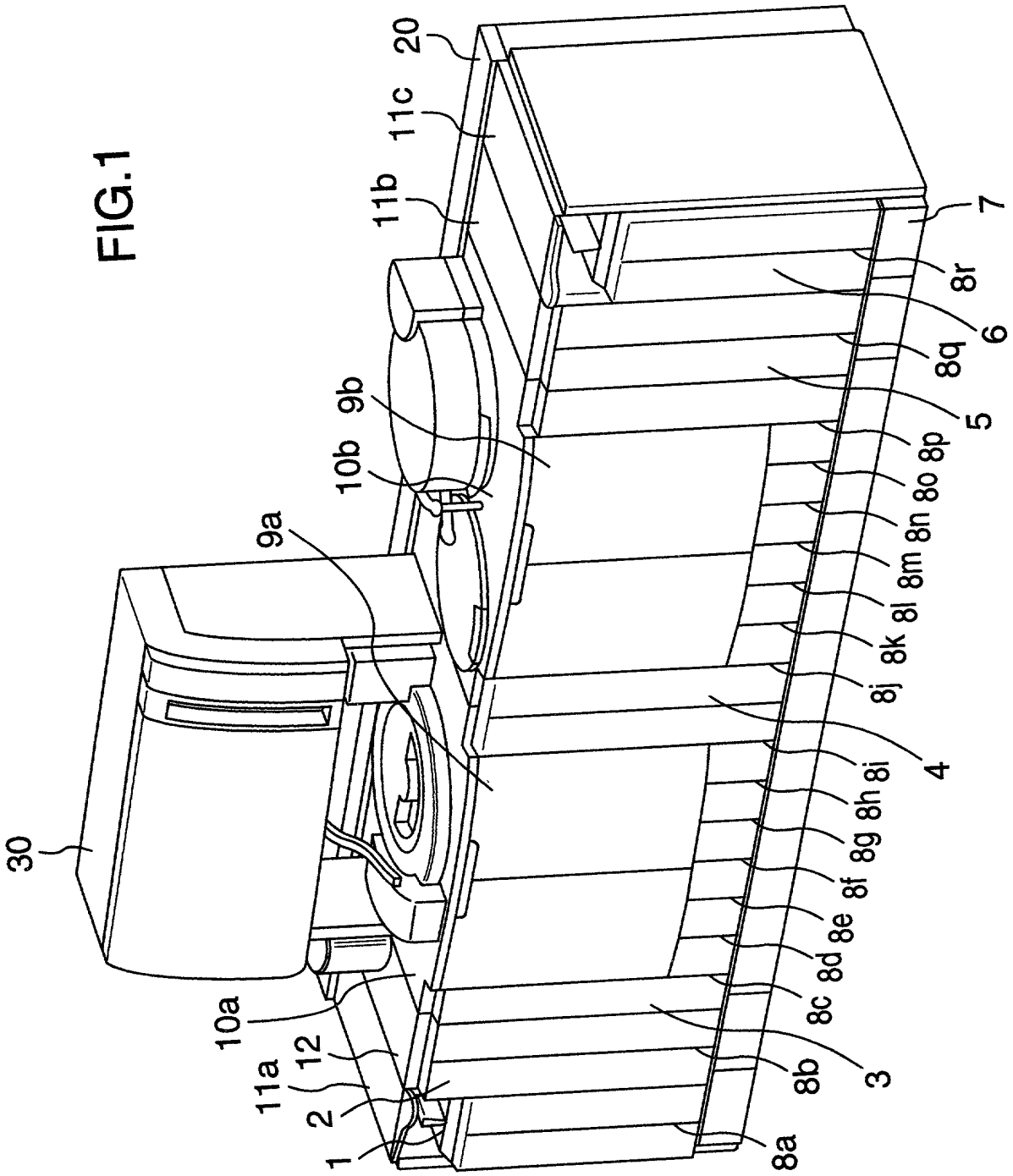
ABSTRACT OF DISCLOSURE

A biochemical analyzer for automatically analyzing components of a specimen, in which a specimen rack conveying part, a specimen introducing part, and a specimen storage part are arranged, independent from one other, and the specimen introducing part, the analyzing part and the specimen storage part are arranged and coupled with one another along the longitudinal direction of the specimen conveying part.

Further, the specimen introducing part, the analyzing part and the specimen storage part have heights measured from a floor surface on which the analyzer is installed, which are in a range of 850 to 950 mm, standardized depths which are in a range of 750 to 800 mm, and standardized widths which are multiples of the longitudinal dimension of the specimen rack.

With this arrangement, external dimensions are standardized so that the respective components give a uniform appearance. Further, since the analyzer has a uniform low height, and accordingly, an examination room in which the analyzer is installed, can be easily looked around in its entirety so as to gives the user bright and broad impression, and the human's feeling function can be controlled so as to give an environment which is comfortable for a laboratory technician.

FIG.1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8q
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8h
8g
8f
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10b
9b

FIG.2

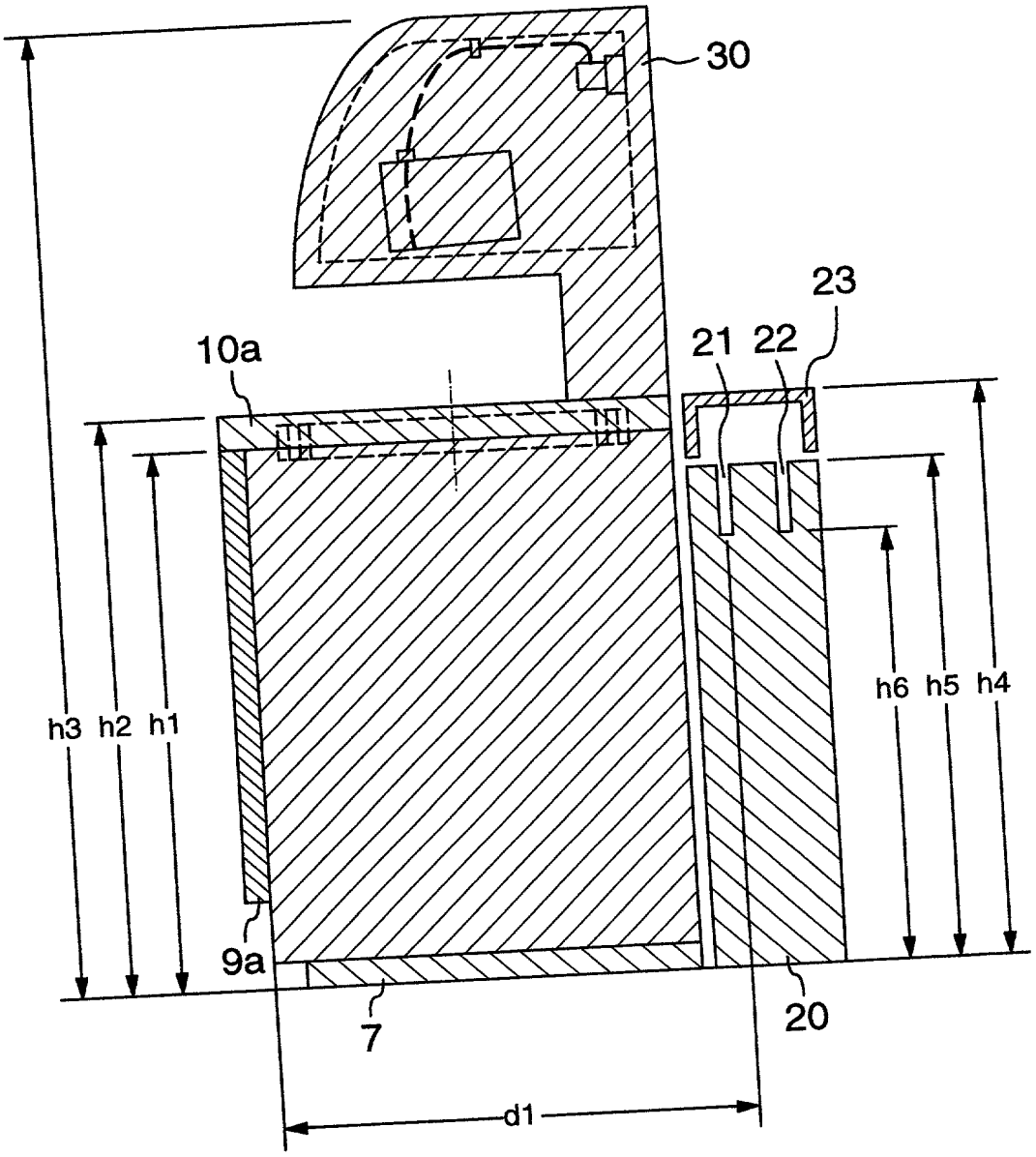


FIG.3

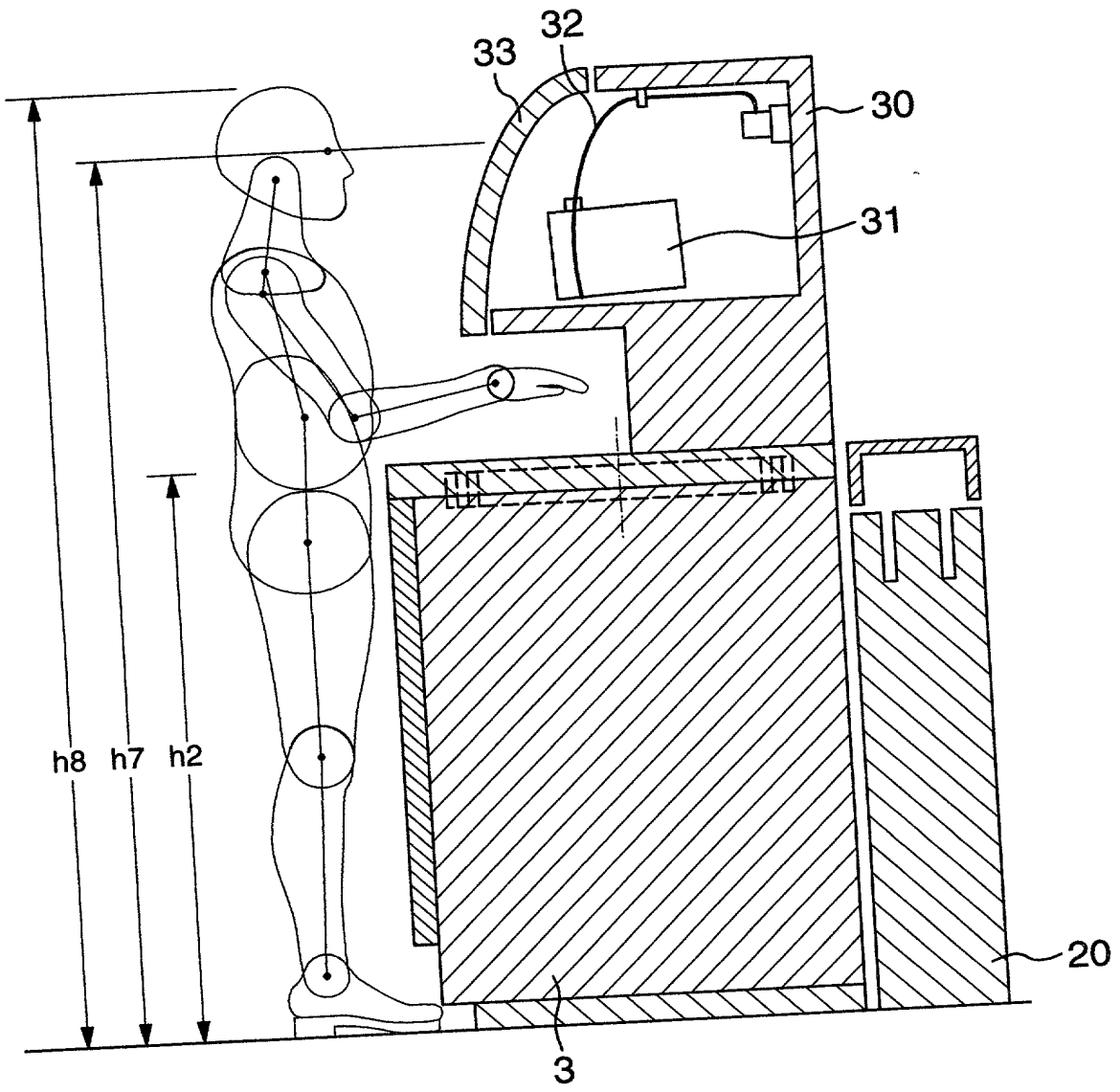


FIG.4

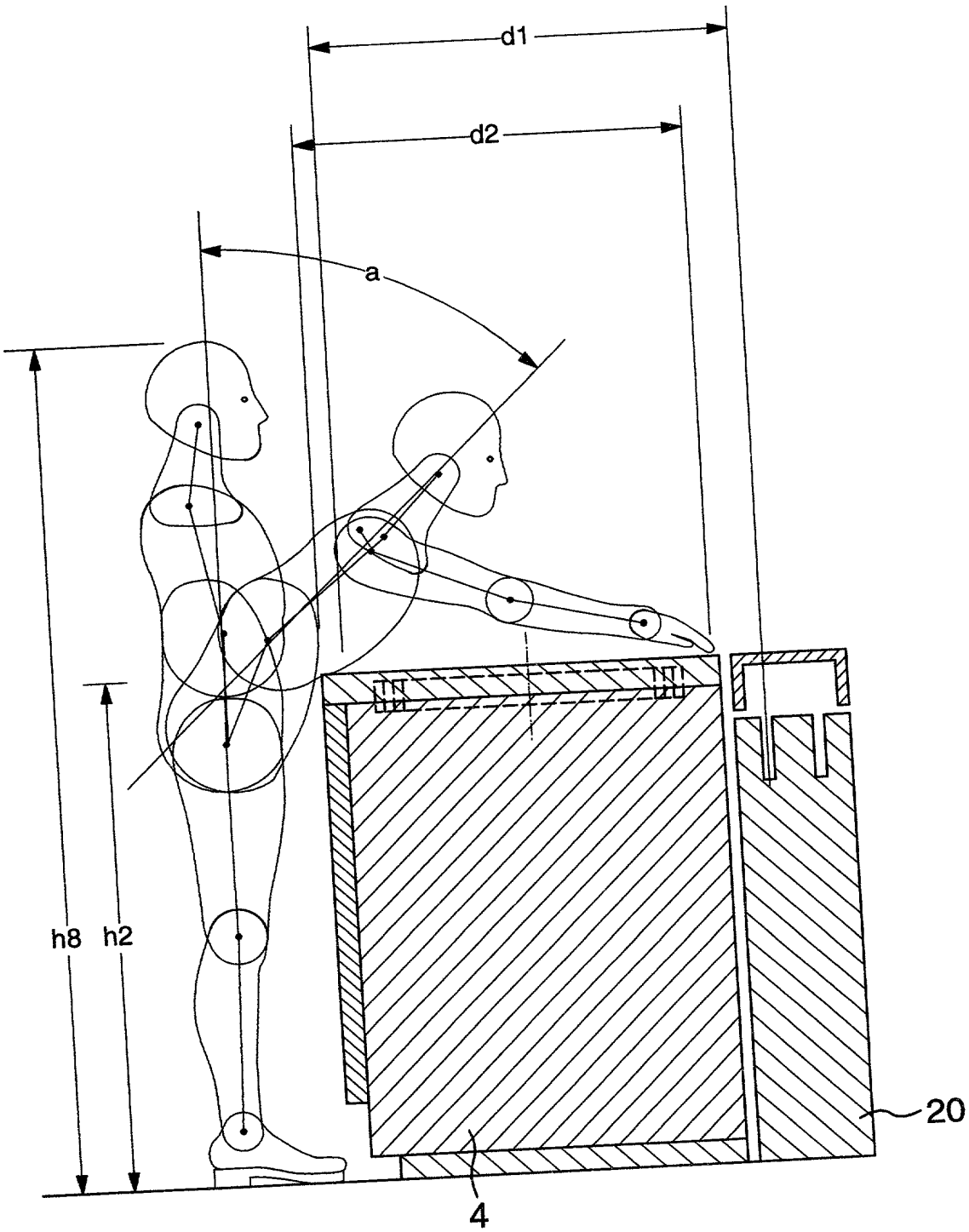


FIG.5

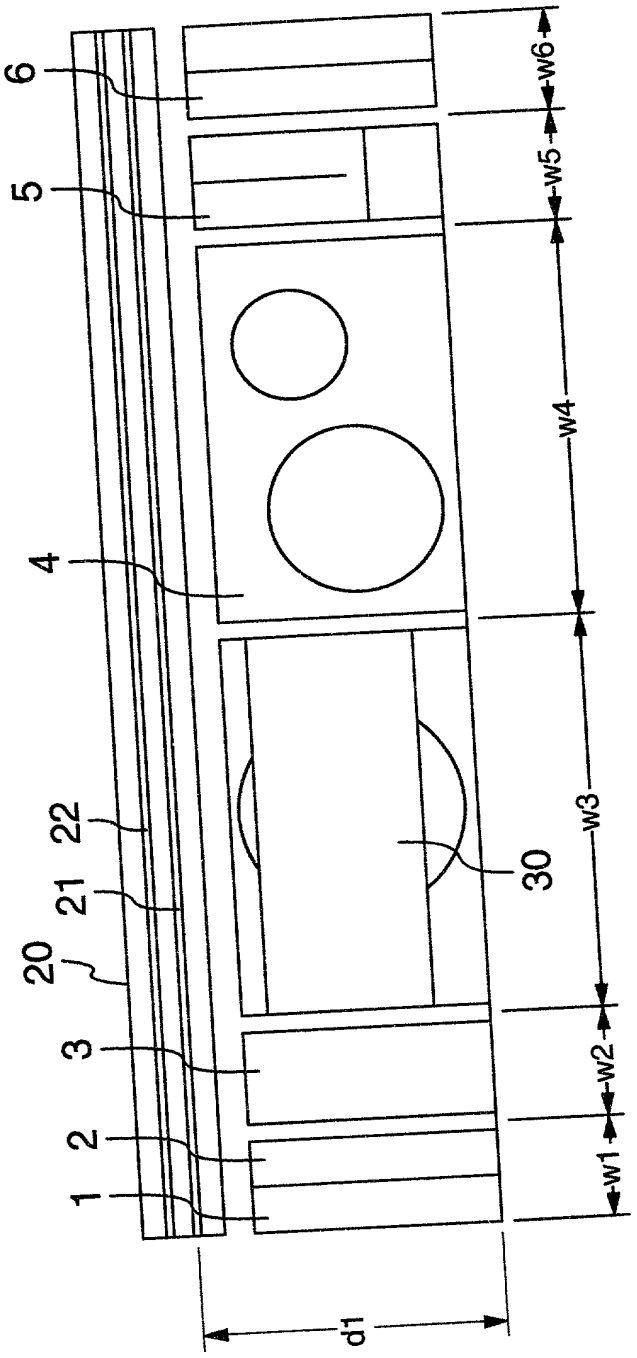


FIG.6

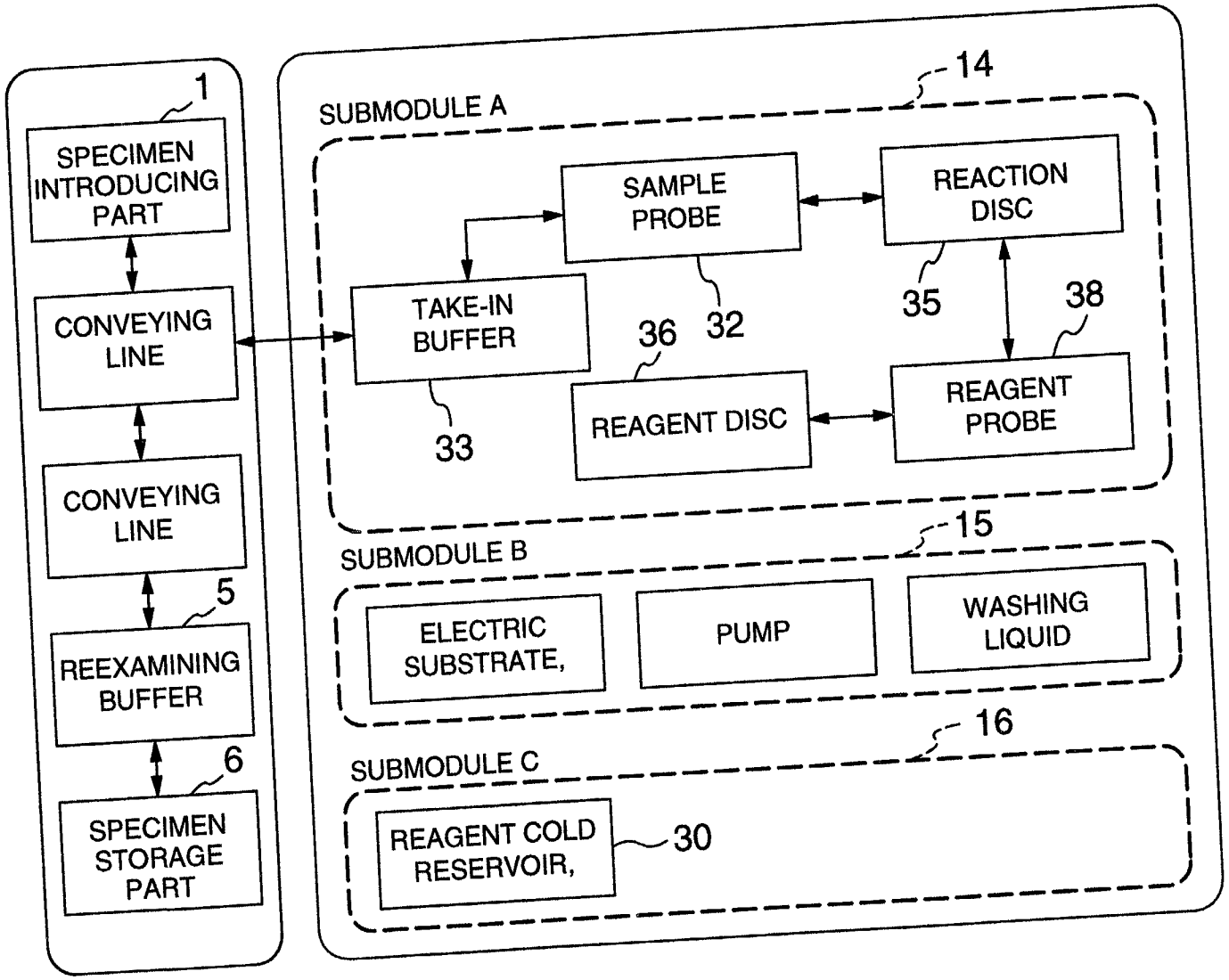
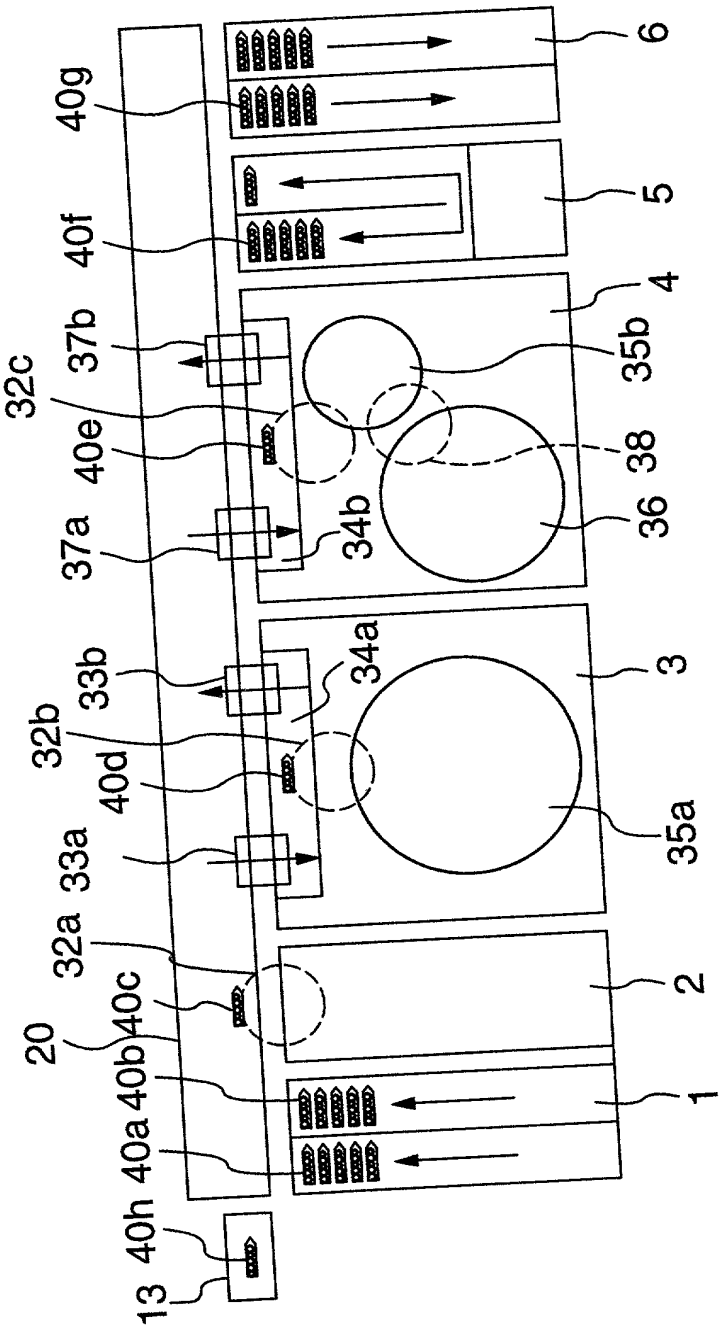


FIG.7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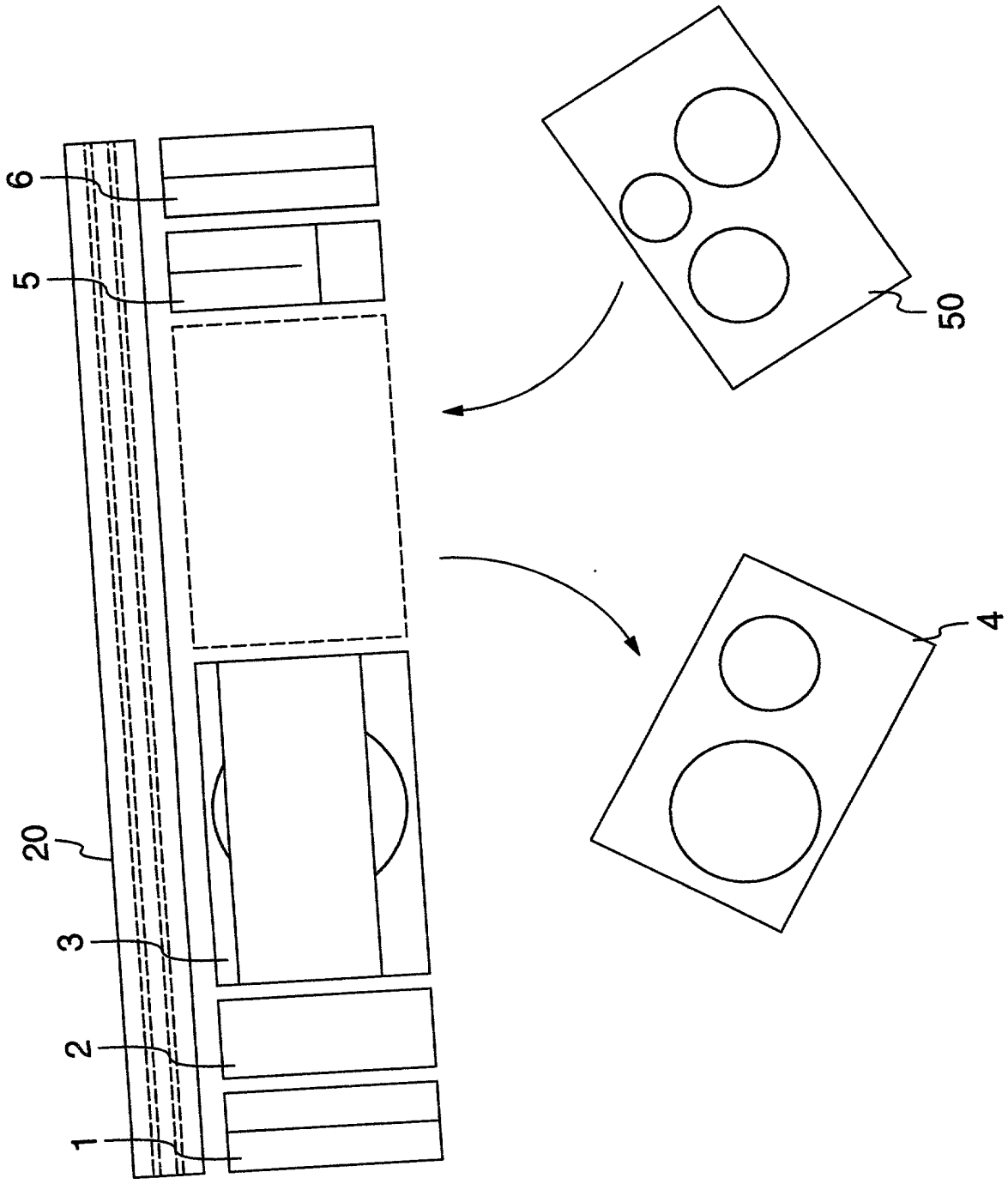


FIG.8

FIG.9a

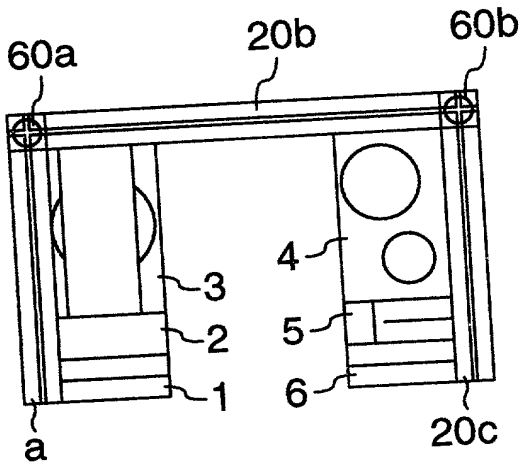


FIG.9b

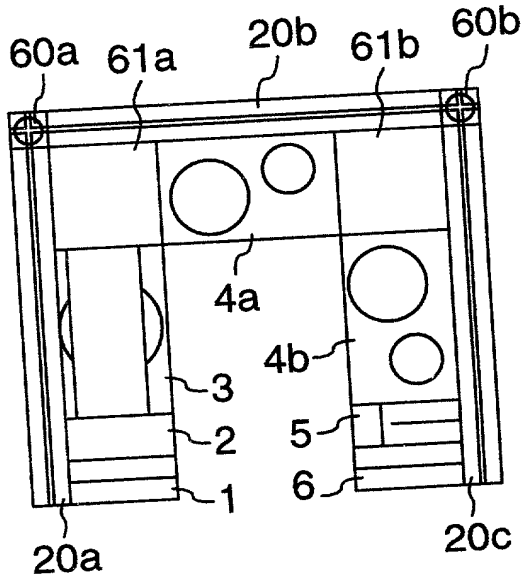


FIG.9c

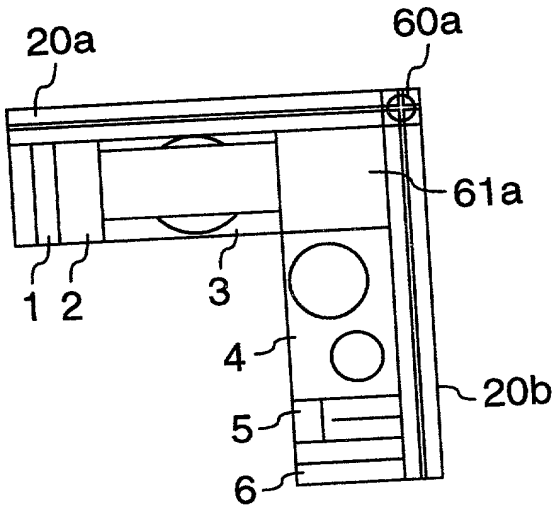


FIG.9d

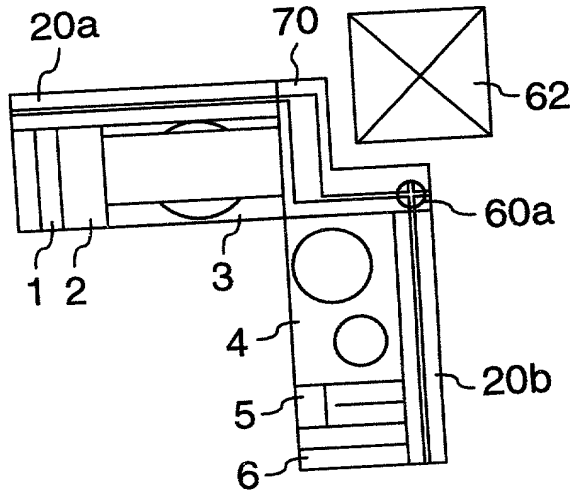
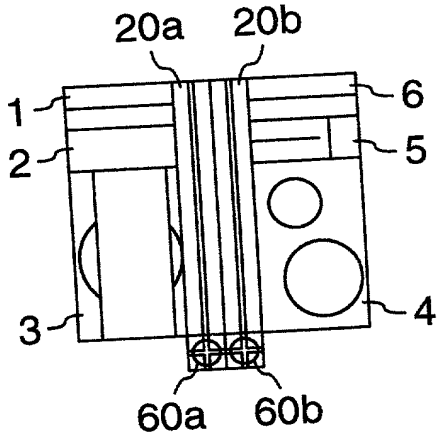


FIG.9e



E4528-0
(*)

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"BIOCHEMICAL ANALYZER"

the specification of which (check one)
☐ is attached hereto.
☒ was filed on October 23, 1996
as Application Serial No. PCT/JP96/03084
and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s) **NONE**			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No
(Number)	(Country)	(Day/Month/Year Filed)	☐ Yes	☐ No

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)

(Continued on Page 2)

I hereby appoint as principal attorneys; Donald R. Antonelli, Reg. No. 20,296; David T. Terry, Reg. No. 20,178; Melvin Kraus, Reg. No. 22,466; Stanley A. Wal, Reg. No. 26,432; William I. Solomon, Reg. No. 28,565; Gregory E. Montone, Reg. No. 28,141; Ronald J. Shore, Reg. No. 28,577; Donald E. Stout, Reg. No. 26,422; Alan E. Schiavelli, Reg. No. 32,087; James N. Dresser, Reg. No. 22,973 and Carl I. Brundidge, Reg. No. 29,621 to prosecute and transact all business connected with this application and any related United States application and international applications. Please direct all communications to the following address:

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Fax: (703) 312-6666

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United State Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(Full Name) (Signature)

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Residence _____ Citizenship _____
Post Office Address _____

Date _____ Inventor _____
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Application

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Washington, D.C. 20231

Application Number	09/284862
Filing Date	April 22, 1999
First Named Inventor	H. KURIYAMA, ET AL.
Group Art Unit	
Examiner Name	
Attorney Docket Number	500.37156X00

22 APR 1999

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Certificate under 37 CFR 3.73(b) is enclosed.

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Typed or Printed Name	Melvin Kraus Registration NO. 22,466
Signature	Melvin Kraus
Date	April 22, 1999

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